Integrating Safety Management in the RHIC Program

DOE-NP Annual S&T Review of RHIC

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July 7-9, 2008

BROOKHAVEN NATIONAL LABORATORY

a passion for discovery

Office of Science

Summary of RHIC Facility Characteristics

- 1 Department (Collider-Accelerator (C-AD))
- >100 Buildings
- 7 Accelerators
- 3 Major Experimental Areas
- 6.2 Miles Of Vacuum Pipe
- 24 Miles Of Cable Tray
- 1000s Of Electro-magnets / Power Supplies
- 10s Of Compressors For Cryogenics Systems
- 62 Electrical Substations
- 1000s Of Electrical Distribution Circuits
- 15 Cooling Towers In Service
- 52 Cooling Systems In Service
- 1.2 Million Ft^2 Of Office And Laboratory Space
- 1000 Acres Of Land
- 1000 Users
- 355 FTE C-AD Staff on RHIC

Summary of RHIC Environmental Aspects

- **Regulated Industrial Waste**
- **Hazardous Waste**
- **Mixed Waste**
- **Radioactive Waste**
- **Atmospheric Discharges**
- **Liquid Discharges**
- **Storage / Use Of Chemicals Or Radioactive Material**
- **Soil Activation**
- **Power And Water Consumption**
- **Sensitive / Endangered Species And Sensitive Habitats**

Summary of RHIC Radiological Hazards

- **Low-level Contamination**
- **Residual-radiation Levels At Collimators and Beam Dumps**
- **Tritium Production In Helium Gas And Cooling Water**
- **Radioactive Waste**
- **Radioactive Atmospheric Discharges**
- **Radioactive Liquid Effluents**
- **Storage / Use Of Radioactive Material**
- **Soil Activation**
- **Residual-radiation From Activated Materials**
- **Very High In-beam Radiation Levels**
- **Sky-shine**

Summary of OSH Hazards

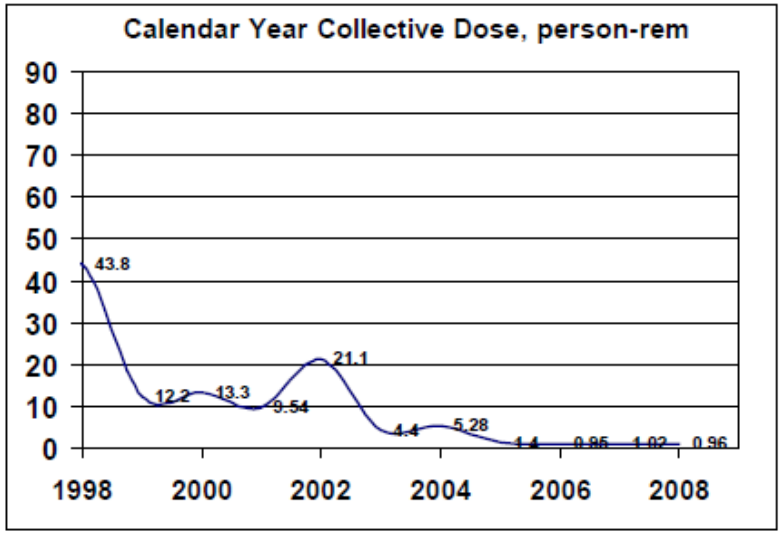
- **Non-ionizing Radiation (Lasers, RF, UV)**
- **Magnetic Fields**
- **Working With Hazardous Or Toxic Materials**
- **Exposure To Electrical Energy**
- **Oxygen Deficiency**
- **Pressurized Vessels**
- **Vacuum Vessels**
- **Confined Spaces**
- **Being Struck By An Object**
- **Cranes and Lifting Devices**
- **Slip and Fall Hazards**
- **Contact With Temperature Extremes**

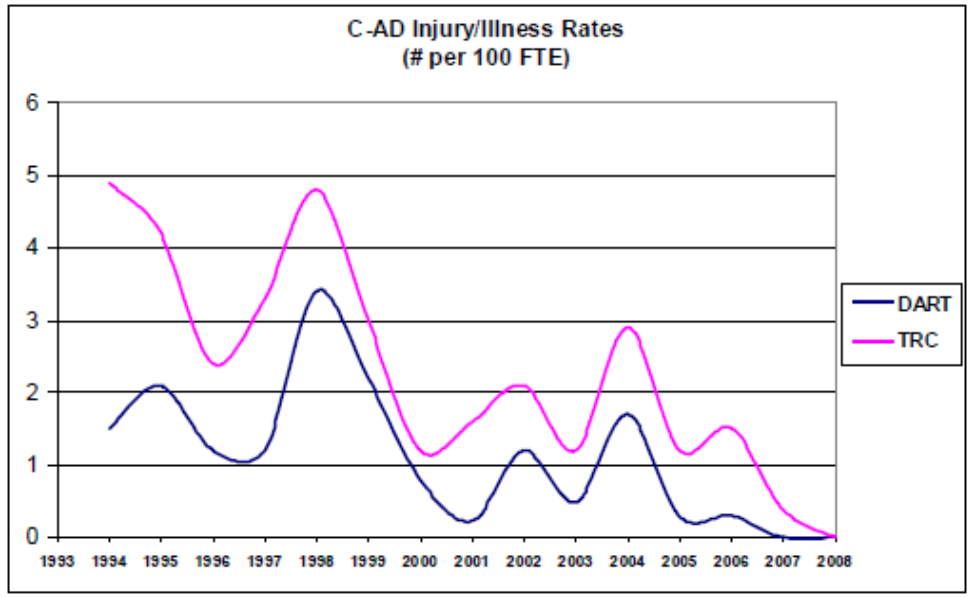
Safety Management Outcome – Short Term (FY07)

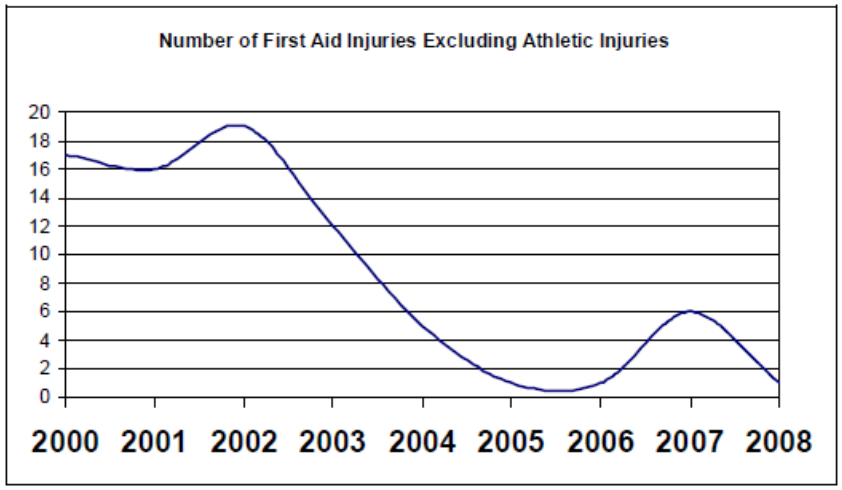
DART		TRC	
Proc. & Prop. Mgmt	7.91	Proc. & Prop. Mgmt	13.84
Safeguards and Security	6.54	Central Fabrication Svc	8.52
Staff Services	4.62	Safeguards and Security	6.54
Plant Engineering	3.53	Waste Management	6.50
Emergency Services	2.56	Plant Engineering	5.46
Radiological Control	2.06	Emergency Services	5.12
Human Resources & OM	2.05	Staff Services	4.62
Contractor - Service	1.51	Human Resources & OM	4.11
Physics	0.83	Radiological Control	2.06
Nat. Sync. Light Source	0.69	Medical	1.72
Collider Accelerator	**0.30**	Environmental Sciences	1.67
		Contractor - Service	1.51
		Nat. Sync. Light Source	1.37
		Physics	1.25
		Collider Accelerator	**0.89**

DART = # of lost time injuries per 100 FTE
TRC = # of injuries per 100 FTE

Safety Management Outcome – Long Term (CY)







How Was Safety Integrated at RHIC – 15 Steps

1. Safety Meetings

- Safety is discussed at every weekly standing meeting for 5 minutes or more
- Some C-AD groups have separate safety meetings
- Suggested topics for discussion are circulated every week by C-AD ESSHQ manager
- Worker Occupational Safety and Health Committee meets quarterly; workers meet and pass comments to managers

How Was Safety Integrated at RHIC – 15 Steps

2. Safety Rules

- We have “10” safety rules that were created with workers, supervisors and managers
- We documented these rules in a procedure that is read and acknowledged every 3 years

3. Enforcement of Safety Rules

- We documented a “just culture” approach to using discipline
- This procedure is read and acknowledged

4. Injury and Incident Investigation

- We investigate every injury and report to all Department staff with a critique
- We investigate every near miss and report to all Department staff with a written critique

How Was Safety Integrated at RHIC – 15 Steps

5. Workplace Audits/Inspections

- We use Tier 1 (safety inspections), Manager Work Observations, Safety Walk Program, individual safety self-assessments, Job Risk Assessments, Facility Risk Assessments, and QA assessments

6. Modified Duty and Return-to-Work Systems

- We have a return to work procedure developed with worker and supervisor involvement

7. Off-the-Job Safety

- Often discussed with workers during manager work observations
- Often a 5-minute suggested safety topic

8. Recognition for Safety Performance

- We consistently use the BNL awards system to recognize safety performance of individuals

How Was Safety Integrated at RHIC – 15 Steps

9. Safety of Facilities and Equipment

- We have focused past efforts on engineered safety systems (access control system, ODH, fire protection)
- Since the arc flash event, PPE availability and electrical equipment design have been our focus
- Recent efforts are aimed at safety-related improvements such as roof repairs, renovation of the power distribution system, and life safety code compliance

Examples of Needed C-AD Improvements that Reduce Risk ($2 to 3M per Year)

S&T Machine Improvement	Improvement Drivers ESH			Improvement Drivers Science			Improvement Driver Other	Building Consolidation Savings And/or Large Intangible Risk Reduction
	OSHA	NFPA	NEC	RHIC	eRHIC	Other		
Building 912 Roof Rehabilitation - $2000K	X	X	X	X	X	CIRC Prototype ERL EDM	Consolidates storage and shop areas Consolidation reduces energy use Consolidation reduces water use Roof improves groundwater protection Eliminates 905 work area	Reduces transportation risks Reduces costs of H-3 monitoring Reduces risk of loss of confidence Reduces risks of electrical injury, fire Saves in BNL space charge Avoids >$10M loss due to shutdown
Rehabilitate Concrete Retaining Wall for AGS Near H-10 - $40K	X			X	X			Reduces risk from falling concrete Reduces risk from uncontrolled radiation exposure Avoids >$10M loss due to shutdown
Restore Required AGS Fire Protection Flow Capacity - $245K	X			X	X			Reduces risk of fire Avoids >$1M loss due to fire damage
Renovate Building 924 - $700K	X	X		X	X	NSRL	Consolidates work areas Consolidation reduces energy use Consolidation reduces water use Improves productivity Eliminates 919, 919A, 919B, 919C, 975	Demolition of 919 saves $0.27M/year Elimination of 919 maintenance backlog saves $0.17M Demolition of 975 saves ~$0.2M/year Elimination of 975 maintenance backlog saves ~$0.2M Crane capacity in 924 improves rigging

How Was Safety Integrated at RHIC – 15 Steps

9. Measuring and Benchmarking Safety Performance

- We have documented the Department's safety performance since 1990 and we report it to Department staff quarterly

11. Hiring for Safety Attitude

- We have a hiring procedure with a set of questions aimed at determining an individual's attitude toward safety

12. Safety of Subcontractors and Users

- We have procedures and Department-level training programs to ensure users and subcontractors perform to the same safety standards we do

13. Involvement in Community Safety

- We participate in Laboratory-wide and DOE-wide safety committees and teams

How Was Safety Integrated at RHIC – 15 Steps

14. C-AD Safety Organization

- The C-AD Chair signs all 1100+ procedures, signs all experiment safety check-off lists each year and signs off all accelerator safety check-off lists when accelerators are modified
- The C-AD Chair holds an annual Management Review and helps set ESSH objectives and targets for next year

15. Safety Specialists

- We have C-AD safety specialists who perform training, independent reviewing, QA assessments, safety engineering calculations, and risk assessments
- They assist in responding to outside assessments, writing procedures, maintaining procedures, maintaining PPE, measuring workplace hazards, planning work, facilitating waste management, and facilitating safety management

Summary

- **RHIC has large facilities with complex hazards**
- **C-AD represents about 20% of BNL workforce**
- **Evidence indicates C-AD safety management system improves performance**
- **Current challenge is to rehabilitate the aging infrastructure**
- **ESSH performance is excellent**